



# Human Centered Design for High Performance Laboratories

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# Human Centered Design for High Performance Laboratories: INTRODUCTION

## *Outline*

- HCDHPL- What It Is, and What It Is Not
- Overview of HCDHPL
- Elements of HCDHPL
- Case Studies



# Human Centered Design for High Performance Laboratories: INTRODUCTION

## ***What It Is....***

- A Strategy Where the Design of the Physical Plant, and the Design for the Physical and Psycho-Behavioral Needs of People Both Contribute to Optimizing the Sustainability of a Habitable Laboratory.

Based on Human Needs  
AND Facility Requirements.

Based on Sustainable  
Design and Construction  
Principles.

Recognizes the Impact of  
Cultural and Social Context.

## ***What It Is Not....***

- Deterministic- Design of the Physical Plant Can Proscribe Particular Human Behaviors.

Facility Focused to the  
Exclusion of Habitability.

Context (Social and Cultural)  
Neutral- Ignoring the Every-  
day Goals, Problems, and  
Activities of People.



## Human Centered Design for High Performance Laboratories: OVERVIEW

### ***HCD for Sustainable Facilities is Not a New Idea...***

- **Don Norman ( Things That Make Us Smart; 1993)** Technology [A built environment] “should be our friend in the creation of a better life; it should [complement human abilities](#), aid those activities for which we are poorly suited, and enhance and help develop those for which we are ideally suited.”
- **Judith Heerwagen, et. al (Towards a General Theory of the Human Factors of Sustainability; 1999)** “...successful green buildings will [integrate](#) sustainable technologies with design features that sustain human emotional, social and cognitive needs.”
- **Kirsten Childs and Randolph Croxton (Human Centered Sustainable Design; 2000)** “...one must address the full [ecology of a building](#): light, air, energy, and human health and well-being.”



## Human Centered Design for High Performance Laboratories: OVERVIEW

### ***HCD for Sustainable Facilities is Relevant to Laboratories***- Laboratory Facilities Are Where People:

- Spend 8 Hours Or More A Day.
- Surrounded By Hazardous Compounds, Bacteria, Viruses, And a Variety of Animals
- Manipulate Unknown Attributes Of The Physical World.
- Work Under Exacting Physical, Intellectual, And Social Requirements.
- Learn And Create.
- Develop and Maintain Personal And Professional Relationships.
- Invest Time, Money, And Reputation On A Hypothesis.
- Value Both Success And Failure.



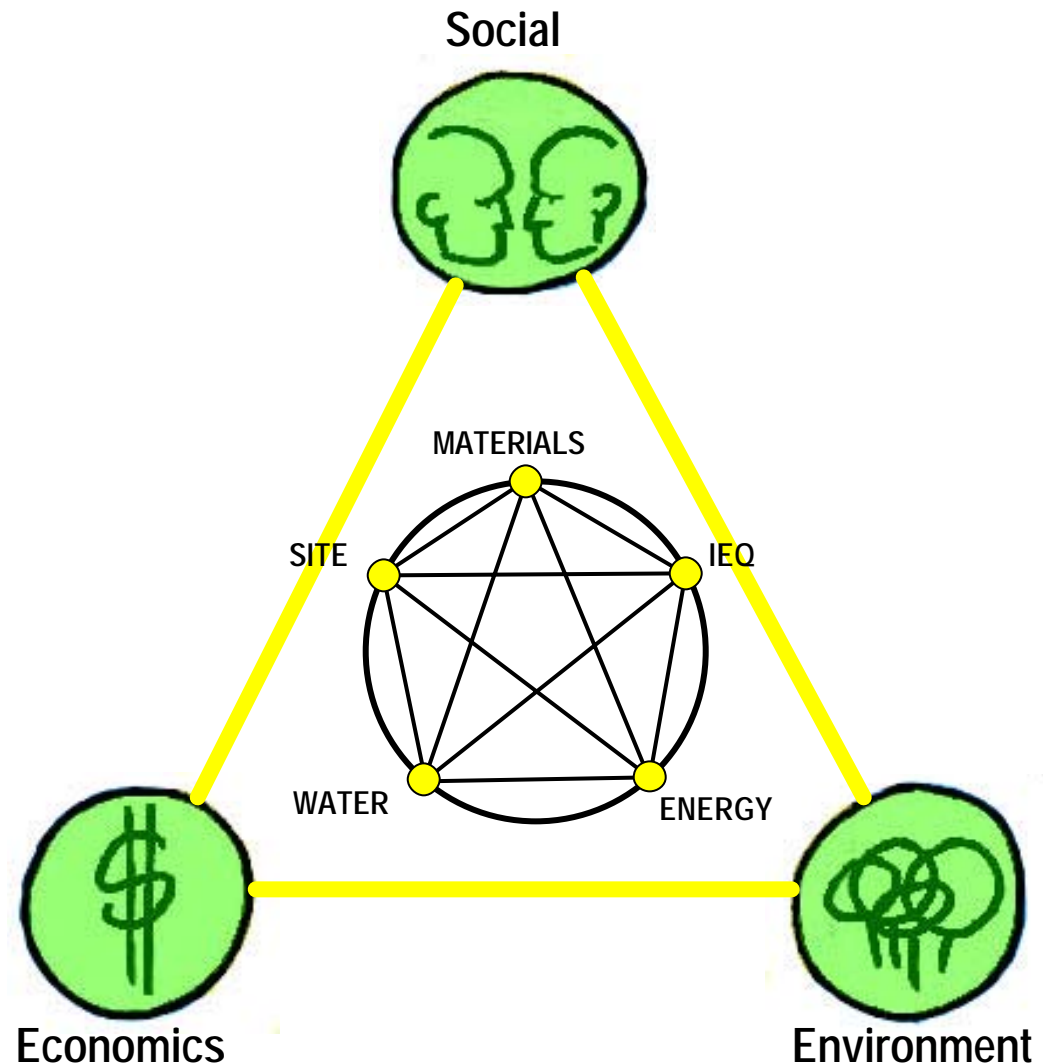
Berry College Science Center



# Human Centered Design for High Performance Laboratories: OVERVIEW

## ***Physical Plant Issues That Impact Facility Sustainability***

- Water
- Energy
- Materials
- Site
- Indoor Environment Quality

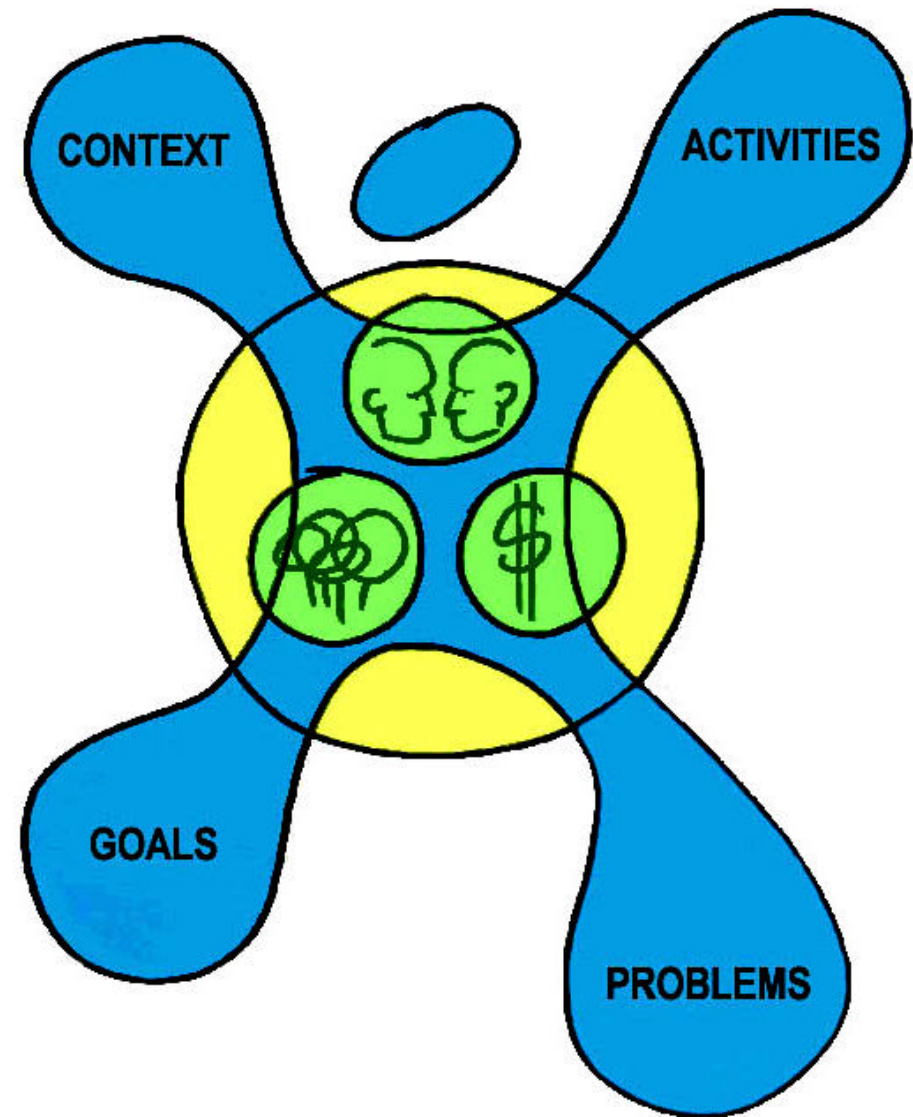




## Human Centered Design for High Performance Laboratories: OVERVIEW

### ***Some Human Centered Design Issues That Impact Facility Sustainability***

- Local Values For Comfort And Well-Being
- Project Team Organization, Formation, And Maintenance
- Universal Design
- Social and Cultural Values of Private and Public Space
- Aesthetics And Beauty
- Biophilia
- Ergonomics
- Place Making For Learning And Creativity
- Facility Security



# Human Centered Design for High Performance Laboratories: OVERVIEW

## *Elements of HCD for Sustainable Laboratories*

### HCDSF Issues That Impact Facility Sustainability:

- Project Team Organization, Formation, And Maintenance
- Human Factor Design
- Facility Security
- Place Making For Learning And Creativity





# Human Centered Design for High Performance Laboratories: OVERVIEW

## *Elements of HCD for Sustainable Laboratories*

- Project Teams
- Human Factor Design
- Facility Security
- Place Making For Learning And Creativity

### These Issues Were Selected Because:

- They Have Significant Influence On The Sustainability Of A Facility
- Help Integrate HCD Into The Design, Construction, And Operations Of Sustainable Facilities
- May Lend Themselves to Objective Measures and Monitoring (LEED?)



## Human Centered Design for High Performance Laboratories: OVERVIEW

### ***Why Is HCD Important To Sustainable Facilities?***

- Ensures That Human “Resources” *Effectively* Contribute to the Triple Bottom Line of Sustainability- Not Met as a Consequential Outcome of Only Physical Facility Design.
- Explicit Language And Methods To Create Habitats That Support And Enhance The Ability Of People To Accomplish Their Tasks.

**‘WHAT IS THE USE OF A BUILT ENVIRONMENT IF YOU DON’T HAVE A TOLERABLE AND SUPPORTIVE HABITAT FOR PEOPLE AND THEIR ACTIVITIES?’**

Modified From H.D. Thoreau, Letter to Harrison Gray Otis, May 20, 1860



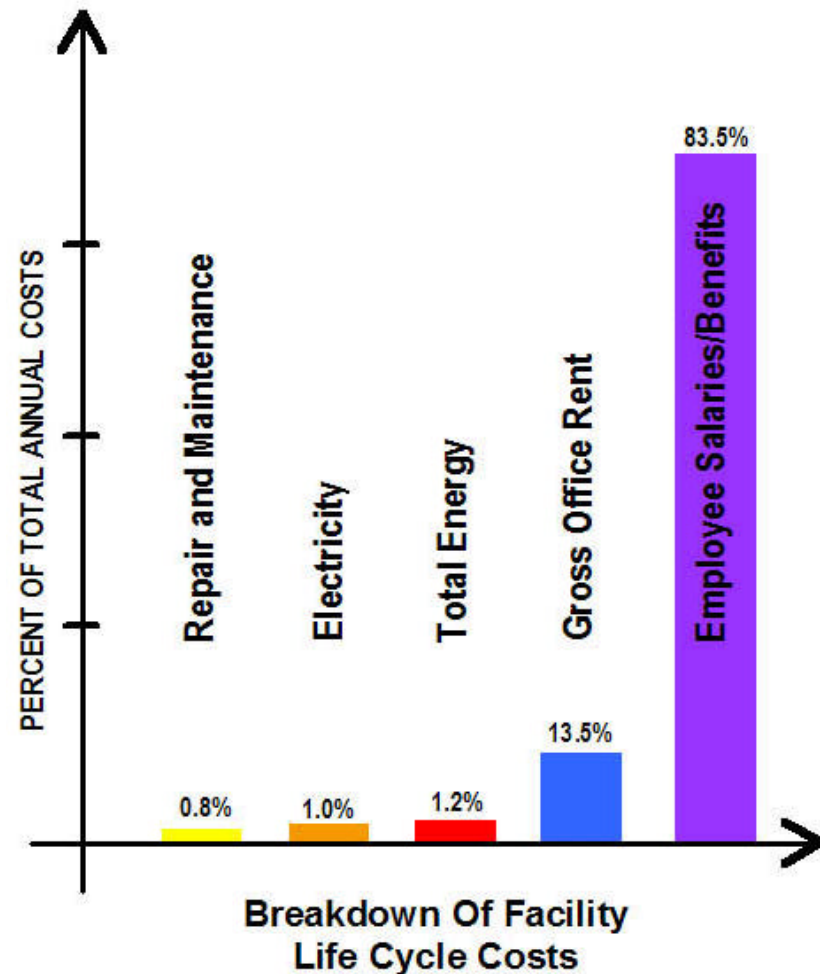
Research II- NCSU Centennial Campus



## Human Centered Design for High Performance Laboratories: OVERVIEW

### *Why Is HCD Important To High Performance Laboratories?*

- Contributes To Creating Laboratory Habitats Where People Learn, Create, And Socialize in Safe, Healthy and Productive Environment. (Strengthens Recruitment and Retention).
- Enhances the “Business of Science” by Strengthening the ROI in the Design that Creates a Habitable Laboratory Facility.

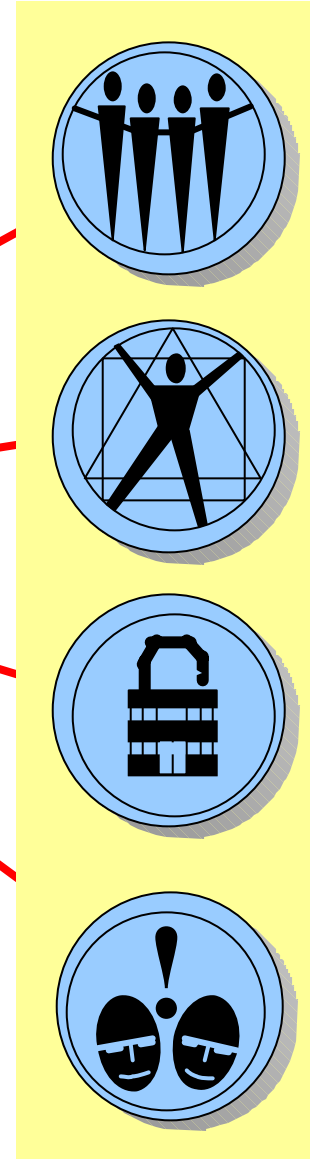


Statistical Abstract Of the United States, 1991



## *Elements of HCD For High Performance Laboratories*

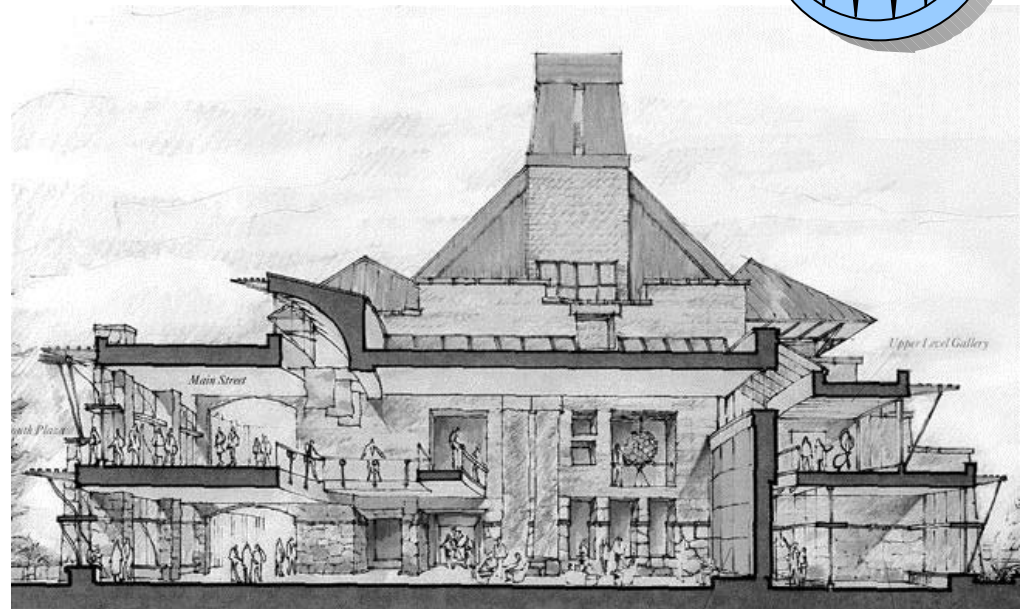
- PROJECT TEAM
- HUMAN FACTORS
- FACILITY SECURITY
- PLACE MAKING FOR  
LEARNING AND CREATIVITY



# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Project Team: Team Formation*

- Developing and Maintaining Integrity
- Early Inclusion Of All Stakeholders
- Create An Atmosphere Of Trust
- Identify "Survival Needs/Well-begin Needs"
- Separate "Needs" From "Wants"
- Communicate -- Beyond Need To Know



EPICenter- Montana State University  
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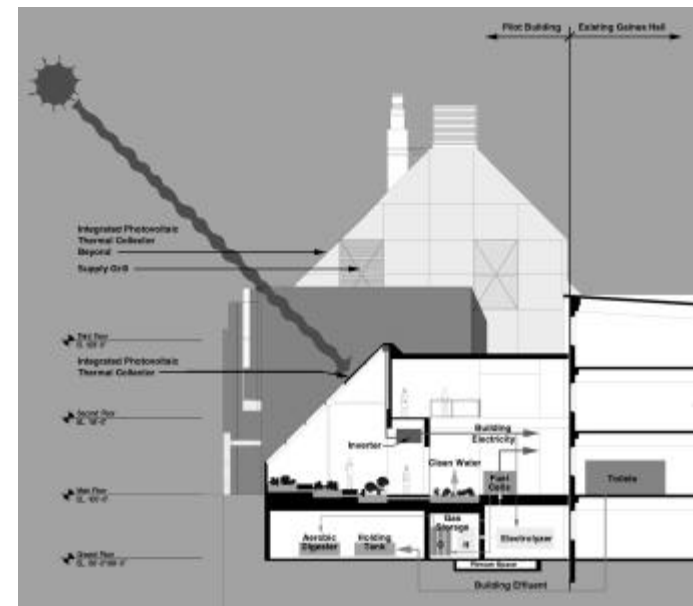


# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Project Team: Understanding Organizational Culture*



- Formal And Informal Structure/Hierarchy Already In Place
- Imposition Of New Structure-the Design Team
- Recognition Of Change Agents- Conventional And “New” For This Project



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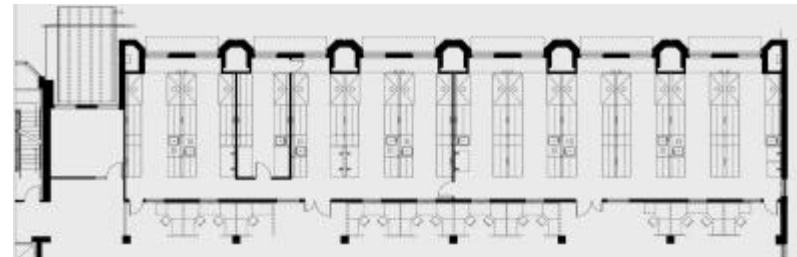


# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Facilitation*



- Personality Versus Skills
- Finding “Fit”- Shared Goals
- Collaboration Among Diverse Constituents
- Clarification Of Roles
- Transparency Of Process
- Separation Of Process And Product
- Continual Education Process



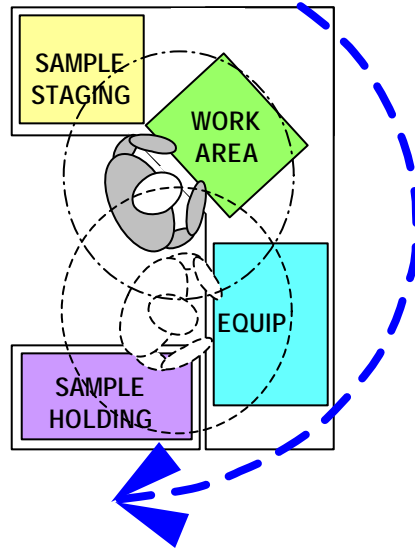
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# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Human Factors*

Work Flow



## ERGONOMICS

Fits Tools, Tasks, and Environment To The Needs Of People

## UNIVERSAL DESIGN

Make Products, Technology, And The Built Environment Accessible To The Greatest Extent Possible, Without The Need For Adaptation.



Case Systems © 2002



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## BIOPHILIA

Designing for People's Innate Affinity For Attributes of the Natural Environment That Have Helped People Survive and Successfully Evolve.



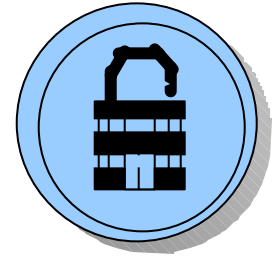
Importance to HCD for High Performance Laboratories:

- Increases Occupant Safety, Productivity, and Morale.
- Decreases Errors, Fatigue, Accidents, Sense of Isolation/Stigmatization



# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Facility Security*



Access Control  
Target Hardening  
Biochemical  
Protection



Crime Prevention Through  
Environmental Design

- Natural Access Control
- Natural Surveillance
- Territorial Reinforcement

**Importance to HCD for High Performance Laboratories:**

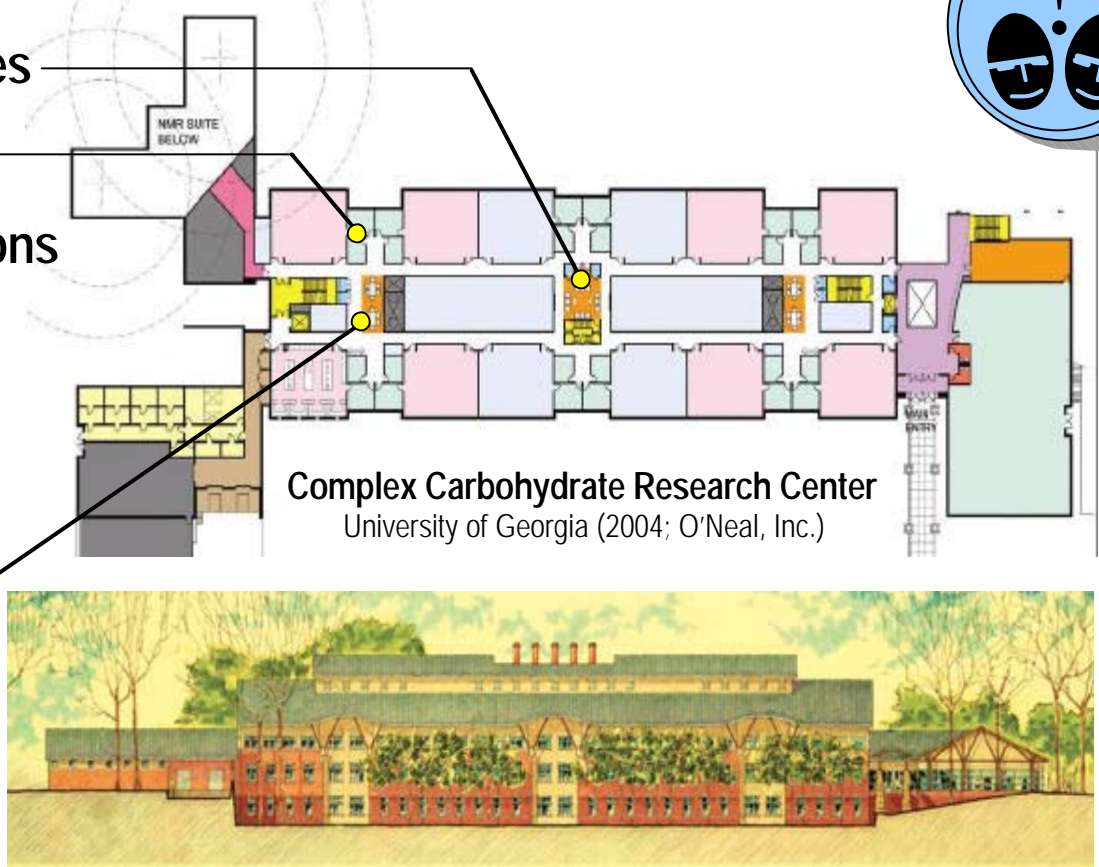
- Increases Actual and Perceived Security of the Facility and People
- Contributes to the Working Integrity of Facility and the Occupants



# Human Centered Design for High Performance Laboratories: ELEMENTS OF HCDSF

## *Place Making for Learning and Creativity*

- Informal Meeting Places
- High Level of Privacy
- Control Over Distractions
- Access to Natural Setting, Inside and Out
- Visually Open and Distant Views
- Places For Play
- Flexible Interiors



Importance to HCD for High Performance Laboratories:  
- Ensures Effective Support and Use of Intellectual Capital



## ***CASE STUDIES***

- ***Case Systems  
Lab Furnishings***



- ***Development  
Resource Center***





# Human Centered Design for High Performance Laboratories: CASE STUDIES

## *HCDHPL Examples: Case Systems Lab Furnishings*

### SUSTAINABILITY

Factory Assembled Lab Utility "Wing" Quickly Installed.

"Wing" Allows Utility Independent Plug-And-Play Lab Bench Location

Easily Modified and Configurable Utilities on Lab Bench

Motorized Lab Bench Height Adjustment from 28" (71.2 cm) to 36" (91.4 cm)

Mobile Bench Ensures Lab Adaptability and Flexibility



Case Systems © 2002

### HUMAN CENTERED DESIGN

Mobile Benches and Utility "Wing" Allow Lab to be Configured to Support Learning and Creativity

Easy Height Adjustment Accommodates People of Different Ages and Physical Abilities

Easy Height Adjustment Can Reduce Accidents and Errors



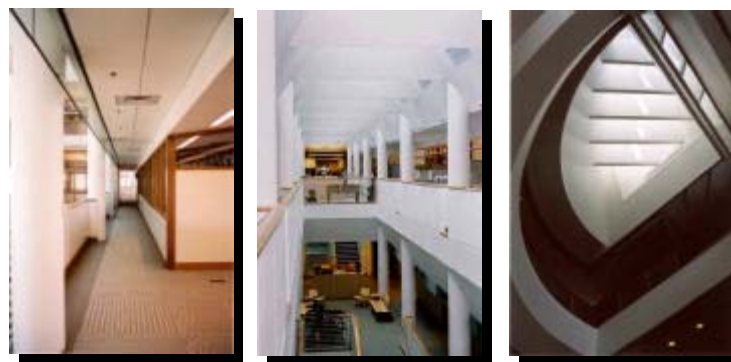


# Human Centered Design for High Performance Laboratories: CASE STUDIES

## *HCDHPL Examples: Development Resource Center; Chattanooga, TN The Croxton Collaborative/Artech*

### PROJECT FACTS

- 85,000 GSF
- \$127.00/SF  
Construction Cost
- Houses 12 City and County Departments Dealing With Development and Construction Issues
- Facility Designed to Transition to 100% Renewable Energy
- Max. Payback = 6 Years
- Estimated 70% Reduction in Energy Use Compared to Equivalent Standard Facility (Baseline: ASHRAE 90.1 1989)



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### HUMAN CENTERED DESIGN

#### PROJECT TEAM

- Established Before Design Process Started.
- All Relevant Stakeholders involved.
- Team Brought Together in a Supportive and Cooperative Environment
- Strong Mandate From City and County to Integrate HCD and Sustainability Into the Design.



# Human Centered Design for High Performance Laboratories: CASE STUDIES

## *HCDHPL Examples: Development Resource Center; Chattanooga, TN The Croxton Collaborative/Artech*

### SUSTAINABILITY

- Facility Oriented to Maximize Use of Solar Energy
- Reuse of Urban Brownfield
- Bioretention Pond for Roof Run-off In City Parking Lot
- Landscaping Used to Modulate Energy Use
- Located on Mass Transit Route (Fuel Cell Buses)
- Bricks Used to Create Parking Lot Striping

### SITE ISSUES



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### HUMAN CENTERED DESIGN

- Entrance At Sidewalk Elevation- No Stairs or Ramps
- Natural Surveillance of the Street From the Building
- Key-Card Access to Limited Exterior Entrances



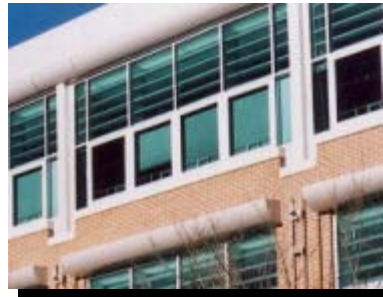
# Human Centered Design for High Performance Laboratories: CASE STUDIES

*HCDHPL Examples: Development Resource Center; Chattanooga, TN  
The Croxton Collaborative/Artech*

## SUSTAINABILITY

- Natural Light From Perimeter Windows and Atrium Skylights
- Glass Smoke and Sprinkler Skirt Maximizes Light
- Photo and Motion Sensors
- Water Efficient Fixtures
- Thermally Broken Operable Windows and Double Layer Building Envelope
- Right-Sized HVAC System
- White Roof

## ENERGY AND WATER ISSUES



## HUMAN CENTERED DESIGN

- Interior Windows Into Most Rooms Increases Visual Access of the Interior and Reduces the Sense of Isolation.
- Atrium Skylight Allows the Sun To Be Tracked On the Interior to Aid Wayfinding and to Orient People to the Time of Day.



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# Human Centered Design for High Performance Laboratories: CASE STUDIES

*HCDHPL Examples: Development Resource Center; Chattanooga, TN  
The Croxton Collaborative/Artech*

## SUSTAINABILITY

- High Durable Materials
- Materials With Low or No VOCs
- Carpet Tiles
- Sunflower Composite Laminate
- Linoleum, Recycled Content Tile, and Cork Flooring
- Abundant Natural Light and Access to Windows

## MATERIALS AND IEQ ISSUES



## HUMAN CENTERED DESIGN

- Height Adjustable Workstation Surfaces With Two Mobile Drawer Pedestals
- Mobile Conference Room Furniture
- Rich Visual Environment
- Areas of Purchase/Refuge
- Bright Visual Field
- High Visual Access
- Clear Wayfinding and Orientation



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## ***CONCLUSION***

**“DESIGN IS THE FIRST  
SIGNAL OF HUMAN  
INTENTIONS”**

William McDonough FAIA, 1999

